

Pennsylvania.—4th, 11th, 12th, 19th.
Rhode Island.—4th.
South Carolina.—3d to 8th, 9th, 10th, 13th.
Tennessee.—3d, 6th, 7th, 8th, 9th.
Texas.—5th to 8th, 10th, 12th, 17th.
Utah.—4th, 5th, 6th, 8th.
Vermont.—7th.
Virginia.—3d, 7th, 9th, 11th, 13th, 14th, 19th.
Washington Territory.—1st, 6th, 10th, 30th.
West Virginia.—2d, 6th, 7th, 8th, 11th.
Wisconsin.—1st, 4th, 6th, 8th, 9th, 10th, 20th, 29th.
Wyoming.—2d, 6th, 9th, 15th, 30th.

The phases of the moon (Washington mean time) during December, as given in "The American Ephemeris and Nautical Almanac" for 1886, are as follows: New moon, 24th, 16 h. 46.5 m.; first quarter, 2d, 21 h. 16.8 m.; full moon, 10th, 16 h. 22.0 m.; last quarter, 17th, 13 h. 30.9 m.; apogee, 2d, 21.8 h. and 30th, 19.1 h.; perigee, 15th, 6.9 h.

MIRAGE.

Fort Assinaboine, Montana: the phenomenon of mirage appeared twice during the 11th. It was first seen during the morning from 8.20 to 8.55, local time. The Fort Belknap Indian agency, twenty-eight miles north of Fort Assinaboine, was plainly visible. Objects appeared magnified to immense proportion and were not inverted but in their proper position. The agency appeared to be surrounded by a dense forest although it is really situated in the midst of an open prairie, but some timber along the Milk River between this place and the agency may explain the appearance of forest. The second mirage was visible towards the west during the greater part of the afternoon; two small lakes, sixteen miles distant and ordinarily hidden from view by a range of high bluffs on the west side of Little Sandy Creek, were plainly visible, the water having a wavy motion, as if stirred by the wind. The sun was shining brightly at the time of both observations.

The following is from the "Independent" of December 18, 1886, published in Inyo, California:

On the morning of the 11th, from the road just south of Independence, California, a very beautiful mirage was seen. A low ridge, about three miles south of the town, shuts off the view of Owens Lake, about twenty-two miles away. In the mirage the whole surface of the lake was seen, with islands and headlands. The mountain on the northeast corner of the lake appeared to come close down to the water, and was as clearly reflected in its depth as in a mirror. Indeed, the entire surface of the phantom lake looked like a great mirror in which the mountains on both sides were reflected.

Saint Vincent, Minnesota: at 7.30 a. m. of the 26th the phenomenon of mirage was seen to the south, the images of trees, houses, barns, etc., were lifted into view.

Mirages were also observed at the following places:

Arizona.—Maricopa, 16th.
Dakota.—Webster, 4th; Henry, 7th.
Kansas.—Salina, 4th, 6th, 9th, 13th, 14th.
Montana.—Poplar River, 8th.

MISCELLANEOUS PHENOMENA.

FOREST AND PRAIRIE FIRES.

Charleston, South Carolina: extensive and destructive forest fires were burning on the 1st between this city and Sumter, along the line of the Central Railroad of South Carolina. At Monck's Corner, thirty-one miles from Charleston, many plantation buildings are reported to have been destroyed. At Stony Landing one hundred cords of wood and other property were destroyed.

Forest and prairie fires were also reported from the following places:

Wilmington, North Carolina: forest fires, 2d, 3d.
 Alva, Florida: forest fires, 27th.
 Fort Sill, Indian Territory: prairie fires, 14th, 18th.
 Fort Reno, Indian Territory: prairie fires, 17th.
 San Antonio, Texas: prairie fires, 21st.

METEORS.

Fall River, Massachusetts: on the 9th, at different times be-

tween 8 p. m. and midnight, numerous meteors were observed starting from near the zenith and passing westward, several of them were followed by bright trains, and a few exploded with a loud report.

At 9 p. m. of the 11th, Geo. W. Smith, master of the schooner "S. B. Vrooman," from Port of Spain, Trinidad, for Mobile, Alabama, in N. 13° 25', W. 65° 55', observed a large meteor passing from south to north, emitting a brilliant light for thirty seconds, and then exploding with a report that jarred the schooner.

Nashua, Hillsborough county, New Hampshire: at 6.09 p. m. of the 14th a meteor, having an apparent diameter of six inches, and followed by a train of red light, was seen to start from near the zenith and pass toward the northeastern horizon.

Grampian Hills, Clearfield county, Pennsylvania: on the 21st, at 7.30 p. m., a large meteor was seen in the western sky 45° above the horizon, and moving toward the south; it resembled a ball of fire, having an apparent diameter of six inches, and followed by a trail of light. The meteor disappeared when at an elevation of about 25°.

Meteors were also observed on the following dates:

California.—Keeler, 19th.
Connecticut.—Bethel, 28th.
Florida.—Archer, 18th; Alva, 19th, 27th.
Illinois.—Geneseo, 6th; Charleston, 19th.
Iowa.—Monticello, 22d.
Kansas.—Salina, 4th, 5th, 7th, 9th.
Louisiana.—Grand Coteau, 12th, 13th, 22d.
Maryland.—Woodstock, 2d, 3d, 11th, 16th, 19th, 21st.
Nebraska.—Valentine, 10th.
Ohio.—Wauseon, 19th, 25th, 29th; Jacksonborough, 21st.
South Carolina.—Spartanburg, 24th, 25th.
Virginia.—Variety Mills, 3d.

MIGRATION OF BIRDS.

Geese flying southward.—Augusta, Georgia, 2d; Chattanooga, Tennessee, 2d; Ninnescah, Kansas, 5th; Brownville, Nebraska, 25th, 28th, 29th; De Soto, Nebraska, 22d; Tatoosh Island, Washington Territory, 9th, 14th, 30th; Albany, Oregon, 8th, 9th, 11th, 30th; East Portland, Oregon, 20th, 22d.

Geese flying northward.—Fort Madison, Iowa, 20th; De Soto, Nebraska, 10th.

POLAR BANDS.

Polar bands were reported from the following stations:

Colorado.—Montrose, 12th.
Connecticut.—Bethel and North Colebrook, 4th.
Florida.—Archer, 3d, 25th, 27th, 28th, 29th.
Illinois.—Riley, 11th.
Kansas.—Ninnescah, 6th, 20th, 29th; Salina, 13th, 29th.
Maine.—Gardiner, 4th, 23d.
Ohio.—Napoleon, 7th, 9th, 10th, 11th, 15th, 22d, 25th, 27th, 28th; Wauseon, 10th, 15th, 20th, 25th.
Tennessee.—Chattanooga, 7th; Nashville, 8th.
Texas.—Abilene, 10th.
Virginia.—Wytheville, 9th, 14th, 19th; Dale Enterprise, 19th.

Wisconsin.—Prairie du Chien, 2d, 3d; Milwaukee, 8th.

SUN SPOTS.

Mr. H. Govey, of North Lewisburg, Champaign county, Ohio, reports having observed sun spots on the following dates: 11th, 16th, 18th, 20th, 27th, 29th.

WATER-SPOUTS.

Capt. L. Dexter, commanding the s. s. "City of Para," reports having observed several water-spouts, between 7 a. m. and 12 noon of the 2d, in N. 37° 38', W. 73° 40' (at noon).

The following is from the "New York Herald" of December 18, 1886:

NEW ORLEANS, December 17.—The British ship "Struan," from Rio Janeiro, reports having encountered, just south of the Mississippi, an enormous collection of water-spouts. The sky was cloudy and the air thick, but the fog suddenly cleared away and showed that the vessel was surrounded by an

definite number of water-spouts, some of them unusually large. There were eighteen in the immediate vicinity of the vessel, and two came so close that it was necessary to change the course in order to escape them. The spouts were shortly after swept away by a whirlwind.

Capt. R. B. Quick, of the s. s. "Eureka," reports having observed a large water-spout on the 22d, in N. 31° 32', W. 79° 10' (at noon).

VERIFICATIONS.

INDICATIONS.

The predictions for December, 1886, were made by 2d Lieutenant John C. Walshe, Signal Corps, U. S. Army, Assistant, and were verified by 2d Lieutenant Frank Greene, Signal Corps, U. S. Army, Assistant.

The detailed comparison of the tri-daily indications for December, 1886, with the telegraphic reports of the twenty-four hours for which the indications were prepared, shows the general average percentage of verifications to be 68.80. The percentages for the different elements are: Weather, 71.21; wind, 66.12; temperature, 66.47. By states, etc., the percentages are: For Maine, 67.07; New Hampshire, 69.49; Vermont, 60.60; Massachusetts, 67.53; Rhode Island, 67.98; Connecticut, 65.38; New York, 72.85; Pennsylvania, 69.84; New Jersey, 70.94; Delaware, 69.14; Maryland, 73.41; District of Columbia, 71.51; Virginia, 72.74; North Carolina, 74.30; South Carolina, 72.80; Georgia, 74.76; Florida, 70.00; Alabama, 66.69; Mississippi, 65.65; Louisiana, 65.91; Texas, 64.78; Arkansas, 63.78; Tennessee, 64.95; Kentucky, 67.04; Ohio, 74.35; West Virginia, 67.87; Indiana, 71.90; Illinois, 72.77; Michigan, 71.99; Wisconsin, 68.05; Minnesota, 68.55; Iowa, 68.71; Kansas, 64.84; Nebraska, 60.86; Missouri, 72.58; Colorado, 65.24; east Dakota, 57.82.

There were three omissions to predict, out of 9,951, or 0.03 per cent. Of the 9,948 predictions that have been made, 1,193, or 11.99 per cent., are considered to have entirely failed; eight hundred and thirty, or 8.34 per cent., were one-fourth verified; 1,892, or 19.02 per cent., were one-half verified; 1,715, or 17.24 per cent., were three-fourths verified; 4,318, or 43.41 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

Below are given for the Pacific coast the percentages of indications verified for November, 1886; this data was received too late for publication in the November REVIEW. The predictions were made by 2d Lieutenant W. A. Glassford, Signal Corps, U. S. Army, Assistant; they were verified by 2d Lieutenant Frank Greene, Signal Corps, U. S. Army, Assistant. The percentages for the different districts are: Washington Territory, 62.79; Oregon, 68.08; northern California, 78.37; southern California, 86.01.

CAUTIONARY SIGNALS.

Of the total number of signals ordered during December, 1886, it was practical to determine the verifications of one hundred and seventy-one; of these, eighty-eight, or 51.46 per cent., were fully verified both as to direction and velocity. Number of signals ordered for northeast winds, thirty-seven; verified both as to direction and velocity, seventeen, or 45.95 per cent. Number of signals ordered for southwest winds, twenty; verified both as to direction and velocity, one, or 5.00 per cent.; verified as to velocity only, one, or 5.00 per cent. Number of signals ordered for northwest winds, ninety; verified both as to direction and velocity, sixty-one, or 67.78 per cent.; verified as to velocity only, three, or 3.33 per cent. Number of signals ordered for winds without regard to direction, twenty-four; verified, nine, or 37.50 per cent. Number of signals ordered late, *i. e.*, after the verifying velocity had begun, four, or 2.34 per cent.

In thirty-nine instances winds were reported which would have justified the display of cautionary signals, but for which no signals were ordered, and in twelve instances winds which would have justified the display of on-shore signals, but for which no signals were ordered.

In addition to the above, four hundred and twenty-seven sig-

nals were ordered at display stations, the verifications of which it was impracticable to determine.

COLD-WAVE SIGNALS.

Total number of cold-wave signals ordered, the verifications of which were determined, was three hundred and fourteen; verified, two hundred and eight, or 66.24 per cent. Seventy-seven signals were ordered, the verifications of which it was impracticable to determine. In addition to the above, in four hundred and ninety instances, the signals ordered at the regular stations were repeated by the observers to towns in their vicinity. The verifications of these it was impracticable to determine.

RAILWAY WEATHER SIGNALS.

P. H. Mell, jr., director of the "Alabama Weather Service," in the report for December, 1886, states:

The verification of predictions for the whole area was 96 per cent. for temperature, and 87 per cent. for weather.

The following corporations comprise this system: South and North; Montgomery and Mobile; Mobile and Girard; Georgia Pacific; East Tennessee, Virginia and Georgia system in Alabama; Memphis and Charleston; Columbus and Western; Atlanta and West Point of Georgia; Northeastern of Georgia; Western and Atlantic; East Tennessee, Virginia and Georgia system in Georgia; Montgomery and Eufaula; Pensacola and Selma; Pensacola and Atlantic; the cities of Milledgeville, Georgia, and Talladega, Alabama.

The following is from the "Bulletin of the New England Meteorological Society" for December, 1886:

Verification of weather signals at New Haven was 68 per cent. for temperature, 84 for weather; at six stations reporting to the Signal Office in Boston, 85 for temperature, 74 for weather.

SUNSET PREDICTIONS.

The characteristics of the sky, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service stations. Reports from one hundred and fifty-nine stations show 4,922 observations to have been made, of which six were reported doubtful; of the remainder, 4,916, there were 4,376, or 89.0 per cent., followed by the expected weather.

STATE WEATHER SERVICES.

The following is an extract from the December, 1886, report of the "Alabama Weather Service," P. H. Mell, jr., of the Agricultural and Mechanical College, Auburn, director:

The most remarkable feature of the month was the heavy precipitation of snow over all parts of the state on the 3d to 5th. Throughout north Alabama 17 to 20 inches of snow fell between the morning of the 3d and the evening of 5th. In middle Alabama 12 to 16 inches were reported during the same period; and in south Alabama as much as 12 inches were reported from several stations. This fall of snow is unusually heavy for this climate, and in some sections was the cause of marked comment, because such a sight had never been witnessed before, especially in the extreme southern part of the state.

The cold waves that were predicted by the Chief Signal Officer on the 1st, 17th, 24th, 26th, and 31st were verified with satisfactory accuracy. It is worthy of note that the frequency of these cold waves over the state during the month has reduced the average temperature 7° 2 below the normal, giving quite a cold winter month for Alabama.

There was a deficiency of precipitation amounting to 1.88 inches.

Summary.

Mean temperature, 43°; highest temperature, 76°, at Mount Willing, on the 12th; lowest temperature, 0°, at Valley Head, on the 7th; range of temperature, 76°; greatest monthly range of temperature, 62°, at Mount Willing; least monthly range of temperature, 39°, at Oswiehee; mean daily range, 18° 4; greatest daily range of temperature, 46°, at Eufaula, on the 22d; least daily range of temperature, 0°, at Livingston, on the 5th, Newton, on the 10th, and Tuscaloosa, on the 1st.

Mean depth of rainfall, 2.97 inches; mean daily rainfall, 0.096; greatest depth of monthly rainfall, 5.20 inches, at Newton; least depth of monthly rainfall, 0.27 inch, at Bernuda; greatest daily local rainfall, 2.20 inches, at Mount Willing, on the 5th.

Average number of days on which rain fell, 7; average number of cloudy days, 13; average number of fair days, 9; average number of clear days, 9.

Warmest days, 23d, 28th; coldest days, 7th, 16th.

Prevailing direction of wind, northwest.

Annual summary for 1886.

Mean temperature, 61° 5; highest temperature, 108°, August 18th, at Birmingham; lowest temperature, -7°, January 11th, at Gadsden; range of temperature, 110°; greatest daily range, 49°, February 23d, at Carrollton, and at Oswiehee on November 1st; least daily range, 0°, on various dates and at several stations.